

# ***BIOMASS SIZE REDUCTION***

**Created by Teachers  
Engineers, and Scientists**



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## **OBJECTIVES :**

1. Students will develop an understanding and appreciation of the importance of coal-related energy.
2. Students will work in teams to solve physical problems.
3. Students will deal with real-world applications relating to bio-mass materials.
4. Students will form opinions and create solutions to everyday problems concerning the receiving, handling, processing, and storage of biomass-related materials.
5. Students will make recommendations on how to reduce costs of these systems.
6. Students will design and develop a system to implement the size reduction of biomass-related materials.
7. Students will physically reduce the size of biomass using the most efficient and economic means available to them.

## **RELATED INFORMATION :**

Coal is a fuel that can provide plentiful, low-cost energy for our industries, businesses, and homes. It is a fuel that can be burned cleanly and efficiently, and is available in abundance in the United States and around the world, in quantities that will last beyond the next century. 90% of our national energy needs will be met by fossil fuels in the year 2020. Research allows coal to be used more cleanly and efficiently and will continue to play a major role in meeting world energy demands.

Biomass fuels locally available include waste materials such as paper, wood chips, and sawdust from lumber mills, pallets, and non-recyclable paper. Biomass also includes energy crops, such as fast-growing grasses and short-rotation woody trees that could be harvested specifically for the purpose of energy production.

By co-firing biomass materials with pulverized coal, we encourage renewable energy sources and reduce fossil energy emissions . Reduction of the size of the biomass will be our challenge for this lesson.

## **PROCEDURES :**

- \* Introduce the topic of biomass burning and explain its use in a coal-fired power plant and its relation with reliable supplies of low-cost clean-burning coal.
- \* Have the students discuss the social, economic, and environmental ramifications of using biomass in a coal-fired energy plant.
- \* Teacher will display different types of biomass materials for students to bring in for their demonstration. The types of biomass used in this project will include :
  - Paper
  - Grass
  - Leaves
  - Hay / Straw
  - Mulch
  - Plastics
- \* Students will bring to class the following day their assigned biomass material for their group project.
- \* Separate students into groups of 5 each and have each group develop a method of reducing the size of the different biomass materials.
- \* Allow each group to present its design of reducing the size of the biomass material to the class.
- \* Students will proceed to reduce their assigned biomass.
- \* Teacher will present the actual methods used in today's technology of biomass reduction.

## **EVALUATION :**

1. Has the biomass been reduced to a usable size ?
2. Did the procedure require repeated efforts to attain this usable size ?
3. Will this size of biomass be energy-efficient if utilized in its present state ?
4. What types of biomass were easiest to reduce ? Most difficult ?
5. How would you improve on this procedure in the future ?

## **SUMMARY :**

Today, coal is an indispensable part of our nation's energy mix. Because of its abundance and low cost, coal has become a primary fuel for electric power and industrial steam production in the United states. Coal use will increase significantly to keep pace with growing energy demands.

Every facet of our economy depends on reliable, low-cost energy. For over a century, fossil fuels -- coal, petroleum, and natural gas -- have been central in filling this need. Fossil fuels account for almost 90 % of our nation's primary energy consumption.

Ensuring reliable supplies of low-cost energy in the future is a key challenge for the United States. To meet this challenge, we must make the best possible use of all our domestic energy resources and reduce our dependence on imported oil. We must conserve energy more effectively, accelerate the use of renewable energy resources, and take full advantage of our domestic supplies of coal.

## **Notes :**

Properly reduced biomass particles will measure approximately one millimeter or smaller. They should be similar in size to sugar crystals. Some of the methods that industry uses are :

- Rotary breaker
- Roll crusher
- Hammer mill
- Impactor
- Tumbling mill
- Roller mill